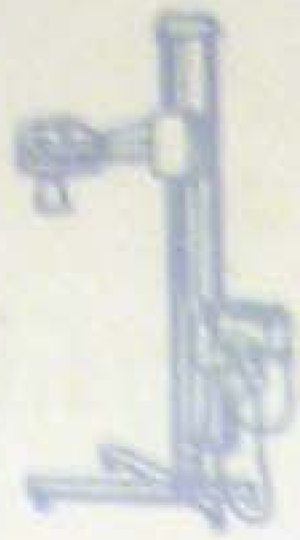
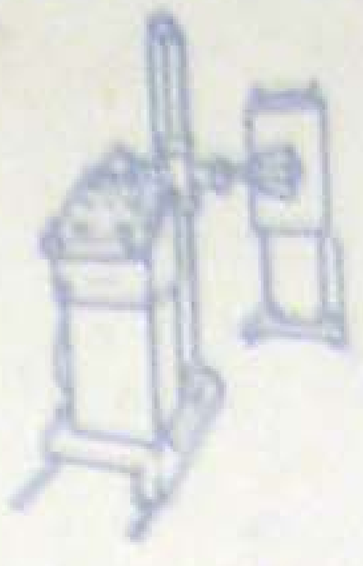

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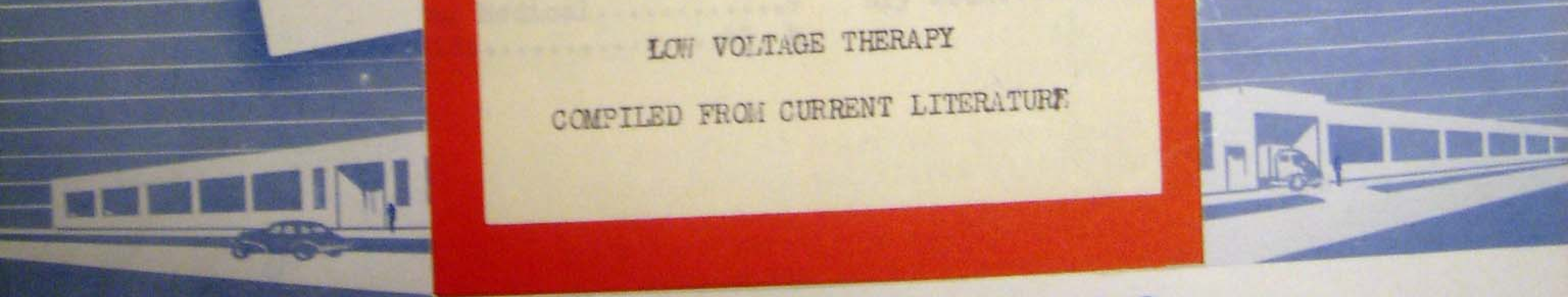

LOW VOLTAGE THERAPY

COMPILED FROM CURRENT LITERATURE

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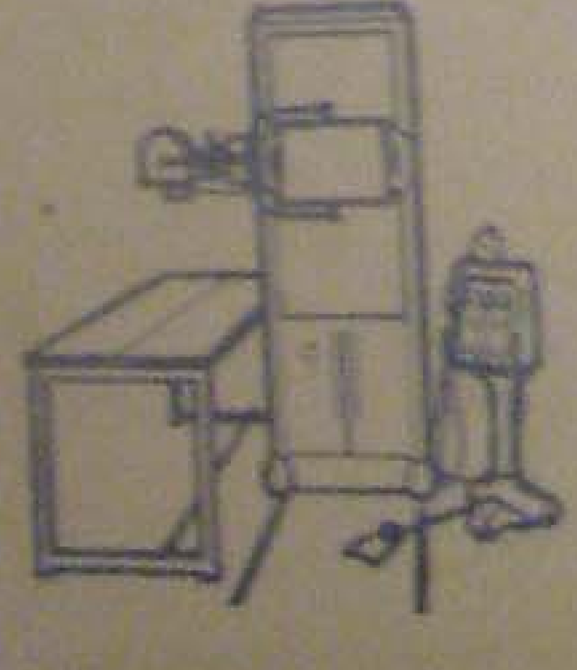
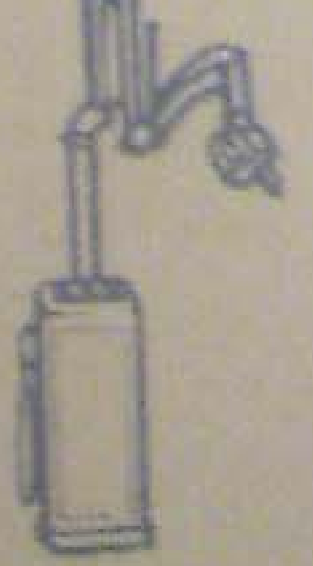
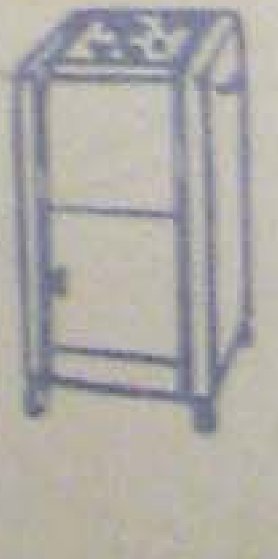

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LOW VOLTAGE THERAPY

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Introduction

A highly effective and dependable modality among the many employed for Physical Medicine is that group of electrical currents conventionally termed "low voltage" energies inasmuch as they are seldom, if ever, applied with potentials exceeding 90 to 100 volts.

It has been said that if Low Voltage therapy were simpler to apply there would be more Low Voltage apparatus in use presently, because its field of usefulness is so extensive and results are so reliable.

In virtually every institution concerned with the problems of rehabilitation, the Low Voltage energies occupy a prominent place in the therapeutic approach.

It has been established irrefutably in thousands of cases that many conditions respond favorably to Low Voltage applications after complete failure under other therapies.

Despite this proved effectiveness these energies have not attained the general popularity enjoyed by some of the other agencies widely used by the Professions, a circumstance to be deplored and attributable, probably, to three causes.

First, the existing literature on the subject is not extensive, having been neglected in the profusion of writings on other devices being exploited more recently.

Second, the verbosity of early workers in the field in coining terminology to identify some of the many possible variations of the Low Voltage currents has led to confusion.

And, third, more attention to technic is demanded for Low Voltage modalities than that usually accorded to the many other devices, a fact often inducing Physicians to forego the proved successes of the Low Voltage energies - to the detriment of the patient.

The preparation of this treatise is undertaken with the sole objective of clarifying some of the seeming complications and thus, perhaps, influencing the Professions to return to the use of a therapy for which there is no substitute.

Low Voltage Energies

One of the chief sources of bewilderment in the consideration of the therapeutic uses of the Low Voltage currents is the multiplicity of knobs, dials, control devices, etc., characterizing the modern apparatus from which the various energy forms are derived. And, concurrently arises the question, "Which combination of these should be employed to treat some specific ailment"?

The solution is greatly simplified by following a logical truism - "Think from the Patient to the apparatus rather than from the apparatus to the Patient". In explanation, having established the objective of treatment, the proper selection of the energy form becomes immediately apparent because each variation of Low Voltage energy manifests itself in the form of an immutable therapeutic reaction.

Thus, the seemingly endless variety of energy forms available can be grouped into categories of therapeutic effect and having established these effects, the selection of a current for a particular purpose is self-indicative.

Biologic Effects

When the human organism is subjected to any of the Low Voltage current variations, one of three physiologic reactions is elicited, as follows;

1. Chemical
2. Contractile
3. Simultaneous Chemical and Contractile.

These effects are the result of two basic types of electrical currents - Direct and Alternating. As previously stated, the terminology employed in the literature in referring to these currents shows wide variation - Galvanic for Direct, Rapid Sinusoidal for Alternating, etc. For the sake of clarity these two currents hereinafter are identified by their simple terms - Direct or Alternating.

The polarity effects of the Direct current are so well established that repetition seems superfluous. However, as a point of reference the important effects are again tabulated?

Positive Pole	Negative Pole
Induced acidity	Induces alkalinity
Repels metals and alkaloids	Repels acids and halogens
Attracts acids and halogens	Attracts metals and alkaloids
Influences vasoconstriction	Influences vasodilatation
Coagulant	Hemorrhagic
Sedative	Irritant

It is of interest to note that the physiologic effects derived from the Positive Pole and the Negative Pole of the Direct current are exactly opposed to each other. Thus, in the therapeutic concept, no chemical reaction can be induced from an Alternating current because any effect created by one pole is promptly neutralized by the counteracting effect of the opposite pole following immediately in the constantly recurring alternating sequence.

Hence, the physiologic reactions, previously outlined, may be traced solely to one or the other of these two Basic Currents, as follows:

1. Chemical effect only . . . . . Direct Current
2. Simultaneous chemical and contractile effects. . . . Direct Current
3. Contractile effect only. . . . Alternating Current

A simple doggerel often is used to fix this principle in the memory:

"D.C. (Direct Current) D-rives C-hemicals."
"A.C. (Alternating Current) A-ids C-ontraction."

The initial step, then, in selecting one of the Low Voltage energies for any specific purpose is the determination of the proper Basic Current as indicated by the therapeutic objective, a procedure which may be summarized as follows:

Therapeutic Objective	Basic Current Selection
1. Chemical reaction only (Ion transfer, electrolysis, pH influence.)	Direct Current
2. Simultaneous chemical reaction with muscle contraction. (Denervated skeletal and ennervated smooth muscle stimulus.)	Direct Current
3. Muscle contraction only. (Skeletal muscle stimulus)	Alternating Current

Having determined the proper "Basic Current", the Low Voltage energizes may then be modified additionally to more nearly conform to the objective as detailed in following paragraphs.

Wave Forms

If the intensity, or "volume", of a Low Voltage energy is sustained at a fixed level, the biologic effect likewise will be sustained in a proportional intensity. For example, if an alternating current is applied to the motor point of a skeletal muscle and the current strength (voltage-amperage) is maintained at a fixed quantity, the subject muscle will contract to an equivalent degree and remain in such contraction as long as the current volume remains unchanged.

This form of Low Voltage current application has been termed, variously, "constant", "sustained", "continuous", etc. Because it is more descriptive of the physiologic reaction with which the ultimate therapeutic objective is concerned, the designation "Continuous" is used hereinafter to identify this sequence in the application of any of the Basic Currents. It is employed in the main with Direct current for sustained chemical effects. In rare instances it may be used with a contractile current to obtain relaxation in skeletal muscle spasm through inhibition.

If the Technician rythmically advances and retards the "volume" control of the apparatus manually, when using a contractile current, it is quite apparent that the subject muscle will alternately contract and relax in synchronous rythm and equivalent vigor to the movement of the control.

Since such procedure is clinically impractical and inaccurate, provision is made in modern Low Voltage apparatus to create the same effect by mechanical or electronic means. Being an undulating rythmic sequence, the term "Surging" seems best to describe such a current form. This modification of any of the Basic Currents is used entirely for contractile effects, particularly in stimulus for increasing muscle tonicity.

Similarly, if the "volume" control of the apparatus is advanced and retarded quickly and sharply, the resulting muscle contraction is manifested as a sudden twitch or jerk. When such a current sequence is generated in Low Voltage equipment, it is variously termed, "square wave", "interrupted", "pulse wave", etc. As the more descriptive term and to differentiate it from the wave-like undulations characterizing a "Surging" energy, this current form is referred to hereinafter as "Pulsing". It is used with the contractile currents principally for denervated muscles.

Thus - the second step in the selection of a Low Voltage current for a particular purpose is evolved and the selection becomes more purposeful when guided by the therapeutic objectives which may be tabulated as follows:

Therapeutic Objective	Basic Current	Wave Form
1. Sustained chemical effect. (Ion transfer, electrolysis, pH influence.)	Direct	Continuous
2. Sustained muscle contraction. (Relaxation of skeletal muscle spasm through inhibition.)	Alternating	Continuous

Therapeutic Objective (continued)	Basic Current (cont.)	Wave Form (cont.)
3. Rythmic muscle contraction with simultaneous chemical effect. (Stimulation of denervated skeletal or involuntary - smooth - muscle.)	Direct	Surging
4. Rythmic muscle contraction only. (Stimulation of enervated skeletal muscle.)	Alternating	Surging
5. Abrupt muscle contraction with simultaneous chemical effect. (Stimulation of denervated skeletal muscle.)	Direct	Pulsing
6. Abrupt muscle contraction only. (Stimulation of enervated skeletal muscle.)	Alternating	Pulsing

It will be noted in the above tabulation that the Direct current in both Surging and Pulsing wave forms is suggested for stimulation of the denervated - impaired nerve supply - skeletal muscle and the Alternating current in both wave forms is suggested for stimulation of the enervated - intact nerve supply - skeletal muscle.

The choice of Wave Form is determined by the degree of impairment or degeneration. The threshold of stimulation - visible contraction of a muscle - in the severely impaired muscle seems to be obtained with less current volume with Pulsing Direct current than with Surging Direct current.

Likewise, the contraction in the enervated skeletal muscle is more vigorous when induced by the Pulsing Alternating current than by the Surging Alternating current.

Rates of Impulse

The primary intent of Low Voltage contractile currents is the production of muscle contraction as nearly as possible the prototype of normal muscle function. Hence, some control over the number of Surging or Pulsing impulses occurring in any predetermined time interval is necessary.

This "rate of impulse" should approximate the normal rate of contraction of the subject muscle. As a typical example, peristaltic waves in the normal colon occur at the rate of 12 to 15 per minute. If a Low Voltage contractile current is to be used in that region, as in the treatment of chronic constipation, it is self-indicative that the Low Voltage Generator control should be adjusted to deliver approximately 12 to 15 surges per minute.

Also, the tonus of the subject muscle must be considered. Manifestly, violent exercise immediately following long immobilization, as in casting for a fracture, is contra-indicated. The sensible course is a graduated series of exercises. Excessively rapid and vigorous contractile stimulation of an atonic muscle by means of a Low Voltage energy is equally contra-indicated. The approach should be gentle stimulus, increasing rapidity of impulse and intensity of vigor only as the tonicity progresses.

In general it may be said that the optimum rate of impulse may be guided somewhat by the length of the subject muscle, i.e., the longer the muscle, the slower the rate of impulse; and the shorter the muscle, the more rapid the rate of impulse.

However, this judgment must be tempered, always, by the existing state of tonicity in the muscle involved.

The Three Primary Factors

At this point it will have been noted that the selection of the proper Low Voltage energy for a specific treatment has become merely the determination of three prime factors as indicated by the therapeutic objective. In summary the progressive steps are:

Step 1. - Determination of the Basic Current - Direct or Alternating - according to the chemical, simultaneous chemical and contractile, or contractile effect desired.

Step 2. - Determination of the Wave Form - Continuous, Surging or Pulsing - according to the desired continuity of the Basic Current selected.

Step 3. - Determination of the Rate of Impulse, the number of surges or pulses occuring per second or minute when using other than the continuous Wave Form.

In some modern Low Voltage apparatus further modification of the Basic Currents is incorporated. One modification is selective control of the number of cycles per second - frequency - of the basic Alternating current, for example, 18 to 3000 cycles. The effects of frequency variation are detailed in a subsequent section.

Alternating Current Frequencies

Domestic commercial Alternating electrical current usually is supplied in a frequency of 50 or 60 cycles - complete alternations comprising one positive half cycle and one negative half cycle - per second, 3000 to 3600 cycles per minute.

It is an established fact that the two physiologic reactions - motor nerve response and sensory nerve response - elicited by the application of an Alternating current are directly proportional to the frequency of alternation.

It is estimated, broadly, that the motor nerve response disappears at frequencies in the order of 10,000 cycles per second and sensory nerve response ceases at frequencies in the order of 1 million cycles per second. In fact, the development of High Frequency Diathermy apparatus was based on this principle.

Selective frequency control of the Alternating Basic Current provides two advantageous variations in Low Voltage applications. First, painful skin effects may be reduced by selection of a frequency sufficiently rapid to minimize sensory nerve response. Since the sensitivity varies in different individuals, no graded rule can be established.

Secondly, and more important, authorities agree that the existing tonus of the muscle governs the optimum frequency selection. In substance, Grodins, Osborne and Ivy found that the threshold stimulation for normal muscle with the least current intensity was in the order of 3000 cycles per minute whereas for polio and peripheral nerve injuries the best response was from 30 to 1500 cycles per minute.

Again, no hard and fast rule can be established but the principle can be correlated in the findings of Kosman, Osborne and Ivy: "The current selected therefore, must be able to produce a vigorous response in the muscle. Such a response, however, must be secured with a current intensity that can be tolerated by the patient".

Summary

To summarize the rationale of "thinking from the Patient to the apparatus", analysis of a hypothetical case may serve best to illustrate the train of thought.

Consider a case of simple trapezius Torticollis - wry neck. Obviously, the therapeutic objective is relief of the muscular spasm. It is logical to assume that this can be accomplished by inhibition through vigorous contraction to - in the words of the laity - "untie the knot".

But, being hypersensitive some sedation should be considered as a preliminary measure. This may be heat or, more effective, vasodilatation by Direct current. Thus, two stages of treatment are presented, (1) the preliminary step of sedation which immediately recalls the Positive Pole effect of the Direct current. And, since contraction is contra-indicated until a later stage of treatment, the Direct current must be used in a Continuous form to avoid contractile stimulus. So, for the initial step the current selection is self-indicative - Continuous Direct.

For the inhibitory stage contraction is indicated. And, since it would seem that continued vasodilatation would also be of value, the Direct Basic Current - being the only one which will induce vasodilatation by polarity effect - remains the choice. Then, the contractile effect must be induced by either the Surging or Pulsing wave form. Finally, because the vigor of the jerking type of contraction tends to inhibition sooner than an undulating rythmic contraction, the indication is Pulsing. Thus, the second stage of treatment becomes, manifestly, an application of Pulsing Direct current.

Concurrently, a process of elimination may be used to select an appropriate Low Voltage energy for the involvement to be treated. Violent massage would never be used on the tenderness of an acute sprain, a condition in which the Low Voltage energies demonstrate complete superiority over many other agencies, when properly employed. On this line of reasoning the Pulsing form of either of the Basic Currents is eliminated because of its harsher response. Likewise, over-tiring of an already atonic muscle is not to be considered so the use of a Continuous contractile wave form is eliminated. Thus, only the Surging Wave Form remains and this is the modification of choice.

It has not been uncommon in the treatment of Neuritis with thermal devices, to find that the treatment accentuates the pain rather than relieve it. In such cases the Low Voltage energies again demonstrate their excellence. And, the introduction in recent years of vasodilating drugs, such as mecholyl and histamine, which lend themselves readily to "ion transfer" has enhanced the value of the Low Voltage principle.

Ion Transfer, variously called "iontophoresis", "ionic medication", "ionization", etc., is based on the principle that ions "driven" by the repelling force of like polarity by a Direct electric current penetrate more deeply into tissue than that obtained from topical applications of the same remedy. Likewise, vasodilating drugs can be introduced with a greater degree of safety, than with hypodermic injections, because the dosage can be more easily controlled and the effect stopped instantly in case of severe reaction.

When the doggerel, "DC drives chemicals", is recalled, the selection of the proper Basic Current for this procedure cannot be mistaken. It can be only the Direct current. And, again since contraction has no bearing on the objective, the wave form can be only Continuous. Finally, being a Continuous wave form, the "rate of impulse" control becomes inoperative and is ignored.

From this precept there should be no difficulty in selecting a proper Low Voltage energy to attain a predetermined therapeutic objective. And, instead of a bewildering multiplicity of controlling devices, the Low Voltage Generator becomes merely a group of three selective modifications (Continuous, Surging, Pulsing) of two Basic Currents (Direct, Alternating) with means for controlling the number of muscular contractions induced per second, or minute, (Rate of Impulse) by the surging or pulsing Wave Forms.

Therapeutic Fundamentals

Low Voltage procedures may be grouped into three general categories:

a. - pH Influence ("Medical Galvanism")
or Ion Transfer ("Iontophoresis")

b. - Tissue destruction by Electrolysis

c. - Muscle stimulation

With the exception of Electrolysis, all treatments are conducted with two wet pad electrodes in skin contact to introduce the current. In Electrolysis, one wet pad in skin contact and one bare metal electrode are employed.

Unless Ion Transfer is indicated, the electrodes should be wet with tap water only. The addition of salt, soda or similar substances merely tends to crystallization upon drying, and an increase in unpleasant skin pricking when again moistened.

Thorough saturation of wet electrodes is required. The most certain method is soaking in warm water for at least ten minutes before use. Excess moisture can then be expelled by squeezing the electrode lightly.

In all applications the current intensity should be increased slowly. The skin sensory effects experienced at the beginning of a treatment are due to inherent resistance of the skin which lessens under the influence of the current. Thus, the dosage can be increased gradually as the skin resistance decreases with virtually no sensation of discomfort.

Any abrasion of the skin in the field of electrode application must be protected to avoid concentration of the current at such a point due to the lessened skin resistance. A coating of collodium, tape or any other similar expedient suffices.

If the polarity influence of either of the Direct Current poles is to be used, a wet electrode of relatively small surface area, hereinafter designated as the "active" electrode, is connected to the selected pole and applied to the area to be treated. The opposite Direct Current pole is connected to a wet electrode of greater surface area, hereinafter termed the "dispersive" electrode, and applied at some remote part of the body to complete the circuit.

In muscle stimulation an "active" electrode small enough to confine contact to a single motor point is recommended. Obviously, if only a flexor muscle is involved it is good therapy to limit stimulation to it alone. An "active" electrode large enough to embrace a number of adjacent motor points, inducing simultaneous stimulation of several related muscle groups may defeat correction of a functional imbalance between a flexor and extensor muscle if both are stimulated alike.

In muscle stimulation procedures it is suggested that the "dispersive" wet electrode be placed on the spine over the point of emergence of the nerve root supplying the subject muscle. For example, in treatments involving an upper extremity the "dispersive" electrode should be placed on the spine in the upper dorsal area; for a lower extremity, over the sacrum, etc.

For conditions involving a nerve, such as brachical neuritis, sciatica, etc., the electrodes may be placed in a manner to favor the nerve course. As an illustration, in Direct current application for brachical neuritis the Positive pole "active" electrode may be placed over the brachical plexus and the Negative pole "dispersive" electrode on the palm of the hand.

For sciatica the Positive pole "active" electrode may be placed over the sciatic notch and the Negative pole "dispersive" electrode under the popliteal space at the knee; or, if the distress so indicates, the "active" Positive pole may be placed over the popliteal space and the "dispersive" Negative pole on the sole of the foot.

Stimulation of abdominal musculature may be induced by either of two methods - local or "reflex". In local stimulation the "dispersive" pad may be placed posterior over the lumbar area and the "active" pad anterior at various points on the abdomen. A conventional plan in the local method is to begin the stimulation at the ileocecal juncture - lower right quadrant - and progressively follow the course of the ascending, transverse and descending colon.

In the "reflex" method - stimulation through the sympathetic nerve system - two small pads of equal size are placed posterior, one on each side of the spine, to cover the coeliacum ganglia, located about two inches laterally on each side of the spine at the level of the third thoracic (dorsal) vertebra. In this procedure care must be exercised to keep the skin area between the two pads thoroughly dry to eliminate a convenient path of less resistance on which the current could complete its circuit and minimize the desired effect on the ganglia.

In all muscle stimulation procedures, as previously stated, the tonus of the subject muscle should be the factor governing the duration of treatment in the initial stage. The demonstration of muscle contraction by Low Voltage stimulation is an interesting and spectacular phenomenon and the temptation is ever-present to extend the treatment period unnecessarily. A more constructive program is an initial application limited to a few contractions with progressive increase in subsequent treatments. In this respect it is not unusual in severe paralysis and muscle damage to limit the first treatment to no more than one or two visible contractions.

Ion Transfer or pH Influence with Direct Current may be administered conveniently to the hands or feet by immersing the member in a water-filled - or in the case of Ion Transfer, the solution of choice - insulated utensil. Ordinary glass or plastic houseware utensils are excellent for this purpose. To conduct the current a strip of metal - the block tin used with Spark Gap Diathermy apparatus serves admirably - is bent to the contour of the utensil and immersed in the fluid with one end overlapping the side to retain it. In use the subject member should not contact the metal conducting strip.

If the immersion method is used, the point of contact between the skin and surface level of the fluid must be protected to eliminate current concentration and excessive skin effects. This is easily accomplished by spreading a layer of vaseline, or some similar unguent, about an inch in width to completely encircle the subject member. It should be so placed that the surface level of the fluid reaches approximately the middle of the protective band when the member is immersed in the solution.

In the immersion method the solution-filled utensil becomes the "active" electrode and is connected to the indicated pole of the Direct Current. The "dispersive" electrode may be a large wet pad placed at any convenient point to complete the circuit.

In recent years the Ion Transfer of histaminic drugs has become a valued addition to Low Voltage Therapy to induce prolonged vasodilatation. The product, "Mecholyl", Merck & Co., Inc. has attained great popularity, probably because of its greater concentration and convenient packaging. The effects are the same as for histamine. "Mecholyl" is used in aqueous solution of 0.2 to 0.5 percent.

Either the local or immersion methods may be used for "Mecholyl" administration. In the local method, as for an articulation such as the shoulder, knee, elbow, etc., the "active" electrode is prepared as follows: Thin asbestos paper - that used for insulating heating pipes is excellent - or a pad of several layers of gauze is saturated with the "Mecholyl" solution and wrapped around the subject member. Over this is placed a layer of tin foil, which should be of slightly less width than the moistened pad to allow about one-half inch of the pad to extend beyond each edge of the foil. The positive pole of the Direct Current is connected to the tin foil by any suitable clip and the entire assembly is held firmly in place by a bandage wrapping. The "dispersive" Negative pole is the customary large wet pad placed at any point to complete the circuit.

In the administration of "Mecholyl" by the immersion method, the procedure is exactly the same as previously described. The same precautions for skin protection at the fluid surface level and for avoiding skin contact with the bare metal current-conducting strip must be observed.

A number of writers have reported excellent success in the treatment of Fungus Infections of the hands and feet by Ion Transfer of copper using a 5% solution of copper sulphate as the medium and the Positive pole of the Direct Current as the impelling force. The immersion method is the procedure of choice in such cases. If both hands or feet are involved and the solution utensil is not of sufficient size to contain both members, two smaller utensils may be employed as the "active" electrode by connecting the two conducting strips together with a piece of wire so that both are common to the Positive pole of the apparatus.

Applications for the bactericidal action of copper or zinc frequently are used for non-specific vaginal infections. The method employs the Ion Transfer principle in which a carbon electrode - inert to the migration of ions from the electrode - is padded with cotton saturated with a 5% solution of zinc or copper sulfate and placed in contact with the vaginal mucosa. Connected to the Positive pole of the Low Voltage Generator it becomes the "active" electrode with the usual larger "dispersive" electrode placed under the sacrum of the reclining patient.

"Electrolysis" implies the destruction of tissue by means of the chemical action of the Direct Current when concentrated in relatively large volume on a comparatively small area. It is used extensively for permanent removal of superfluous hair through destruction of the hair follicle and other procedures in which the actual destruction of tissue is the objective. The treatment of Hemorrhoids, Cervical Stenosis, Cervical Erosions, and similar procedures are predicated on the electrolytic theory.

The principle of "Electrolysis" is best illustrated by a simple experiment. If the tips of the conducting cords from the treatment terminals of a Low Voltage Generator are immersed in a solution of ordinary salt water, a visible phenomenon appears when the Direct Current is turned on. It will be seen that bubbles arise in the solution from both of the cord tips with more forming about one of the tips than around the other.

The action which takes place under these conditions is a breaking down of a chemical compound comprised of "H_2" (hydrogen) "O" (oxygen) - the water - and "Na" (sodium) "Cl"(chlorine) - the salt (sodium chloride). The first-named chemical of a compound is inherently of Positive polarity and the second-named, Negative polarity. Thus - from the law of physics that "like poles repel and unlike poles attract", a migration of the ions in the compound takes place under the polarity influence of the Direct Current.

The Positive Hydrogen and Sodium ions are repelled by the Positive pole of the Direct current and are attracted to the Negative pole. Likewise the Negative Oxygen and Chlorine ions are repelled by the Negative pole of the Direct current and are attracted to the Positive pole.

These clouds of ions accumulating around the respective cord tips account for the visible phenomenon previously mentioned. The bubbles formed at the cord tips arise from the Oxygen concentration around the tip of Positive polarity and the Hydrogen concentration around the tip of Negative polarity. Consequently, more bubbles form at the Negative pole because of the composition of the water, H_2O, in which there are twice as many Hydrogen ions (H_2) as there are Oxygen ions (O). This test, incidentally, is a convenient method for determining the polarity of a Direct Current application.

A second invisible action takes place through the ion movement in the formation of new chemical compounds at the respective cord tips. Some of the Positive Hydrogen ions come in contact with the Negative cord tip and lose their normal charge to become nascent ions bearing the Negative polarity transmitted by the stronger influence of the pole contacted. In this state, they are capable of uniting with ions of unlike polarity, so, they unite with adjacent Positive Sodium and Oxygen ions in the vicinity to form "$NaOH$" - Sodium Chloride.

Concurrently, some of the Negative Chlorine ions contact the cord tip of Positive polarity and assume its Positive charge enabling them to combine with some of the Negative Hydrogen ions in the area to form "HCl" - Hydrochloric Acid. From these mutations are adduced the maniliar polarity characteristics of the Direct Current, namely, "Positive pole - Acid reaction", "Negative pole, alkaline reaction". And these are the characteristics upon which the principle of "Electrolysis" for tissue destruction is based.

The fluids of the human body contain chemical compounds which are subject to the same disassociation, ion migration and formation of new compounds as those used in the foregoing experiment. By concentrating the Direct current on a small enough area, the formation of these caustics may be created in sufficient intensity to destroy tissue.

In the treatment of Hypertrichosis (Superfluous Hair) a very fine needle, especially made for the purpose, is inserted along the hair shaft to contact the follicle. Connected to the Negative pole of the Low Voltage Generator it becomes the "active" electrode. The Positive "dispersive" electrode may be a large wet pad under the palm of the hand, or a utensil containing salt water solution to be used by the immersion method, in which the patient alternately immerses and withdraws the fingers to "make" and "break" the circuit. The current concentration on the small area of the needle is highly intensified and the production of the Sodium Chloride at this point destroys the hair follicle through its caustic action.

A similar procedure is used in the obliteration of Hemorrhoids. In this instance another type of needle, designed for this particular application, is inserted into the Hemorrhoid as the Negative "active" electrode and a large Positive "dispersive" wet electrode is placed under the hip to complete the circuit.

There are two paramount reasons for using the Negative pole for these and similar "Electrolysis" procedures. First, it has been noted that the action of the Positive pole "repels metals. Hence, the movement of ions from the needle into the tissues creates a "tattooing" which certainly must be avoided. Secondly, it will have also been noted that the action of the Positive pole is "coagulant". If the Positive pole is used in contact with mucosa, the coagulant effect causes sticking of the bare metal electrode in contact with the tissue to the point that the area may be denuded of tissue in attempting to remove the instrument.

A number of conditions are amenable to treatment by "Electrolysis". The softening and stretching of Strictures of the Esophogus and Urethra by means of Negative pole applications has been known for years. Suitable olive-type electrodes in graduated sizes are passed through the constricting band in progressive treatments. Functional Cervical Stenosis with all of its sequelae may often be relieved on the same basis. Again, electrodes designed for the purpose are required. Endometritis and Cervical Erosion are subject to the same approach. All such applications are predicated on the production of caustic Sodium Hydroxide at the Negative pole of Direct Current to devitalize the tissue by "chemo-coagulation".

It is not practical to establish a rigid time of treatment for Low Voltage Therapies. In each category the duration of the application must be judged according to the therapeutic objective. For example, as has been stressed previously, regenerative muscle contraction will be governed by the tomus of the subject muscle. Inhibitory muscle contraction for relief of spasm must be of sufficient duration to induce the desired relaxation. In Ion Transfer the duration of treatment will be governed by the amount of current - milliamperage - employed in the individual application. The safest guide is the long-established rule of"tolerance".

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GENERAL THERAPEUTIC PROCEDURES

Electrodes must be maintained in firm contact with the patient's skin throughout the treatment period. This may be accomplished by placing the electrode under the reclining patient, by weighting with sand bags, by retaining with rubber bandage or any similar expedient.

If the electrodes tend to dryness during an extended period of treatment, the water, or other indicated solutions, may be replenished conveniently from a syringe of the Asepto type. The solution is added very solwly at the exposed edges of the electrodes.

The current volume should be increased slowly for all treatments and especially so with Direct current applications. It will be found that much greater current intensity can be applied with less discomfort to the patient if a full minute is utilized in advancing the current intensity to the possible maximum.

In Electrolysis and Ion Transfer it is advisable to double check the polarity of the cord to be attached to the active electrode. This can be done by a salt water method described on page 12, or, by using moistened red litmus paper which will turn blue from the alkaline reaction at the Negative pole when the two cord tips with current flowing are touched to it.

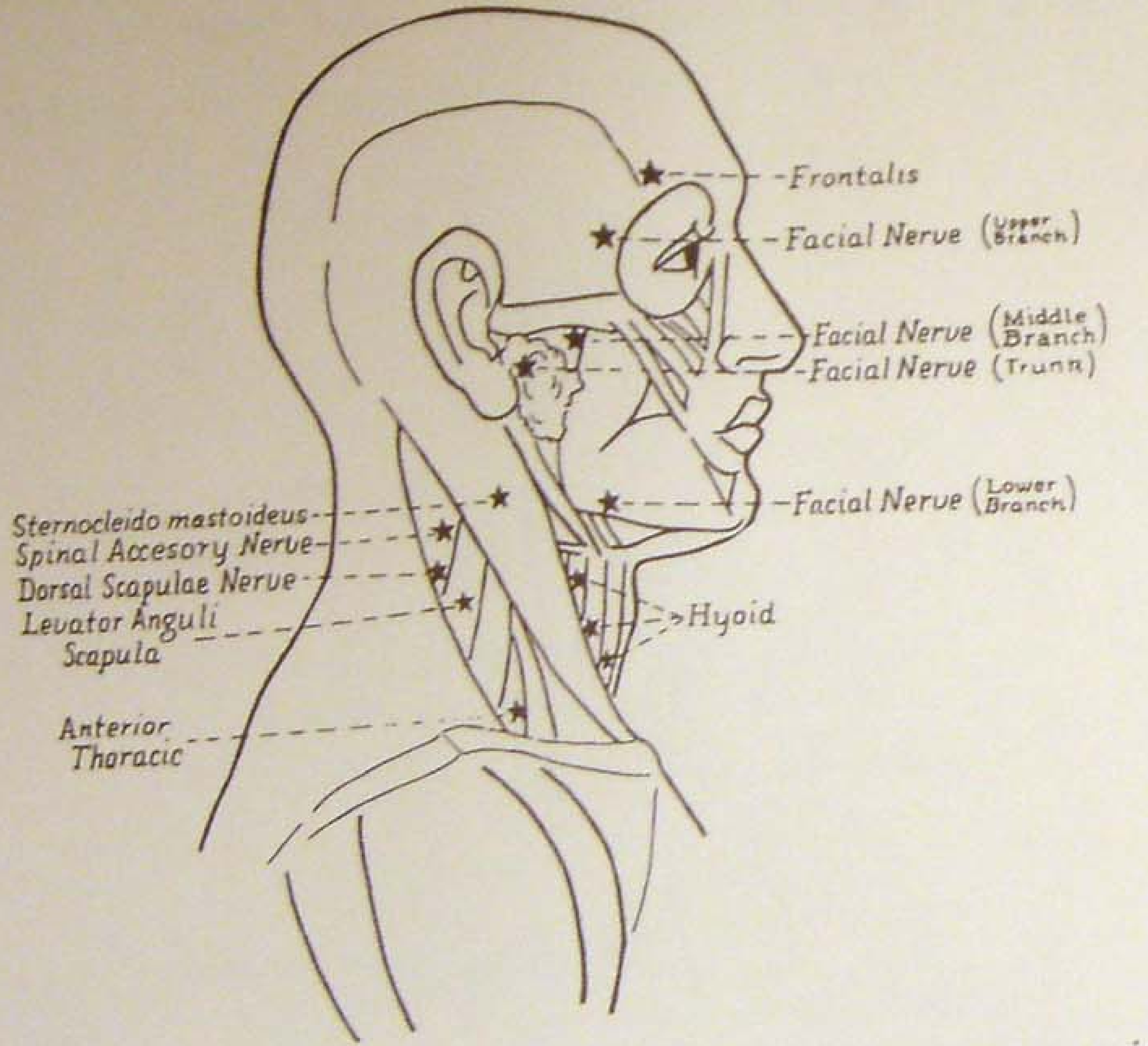
Open abrasions of the skin, excepting ulcers toward which the treatment is deliberately directed, must be covered with a coating of collodium, tape or other protective material if they appear in the field of electrode application. Of course, this does not apply in such conditions as fungus infections in which, again, the treatment is directed toward the infection.

Use and Explanation of the Fischer Electro-Diagnostic Charts

Galvanic and Contractile Currents Generators afford excellent means for making correct electrical diagnosis to determine the degree of paralysis and reaction of degeneration.

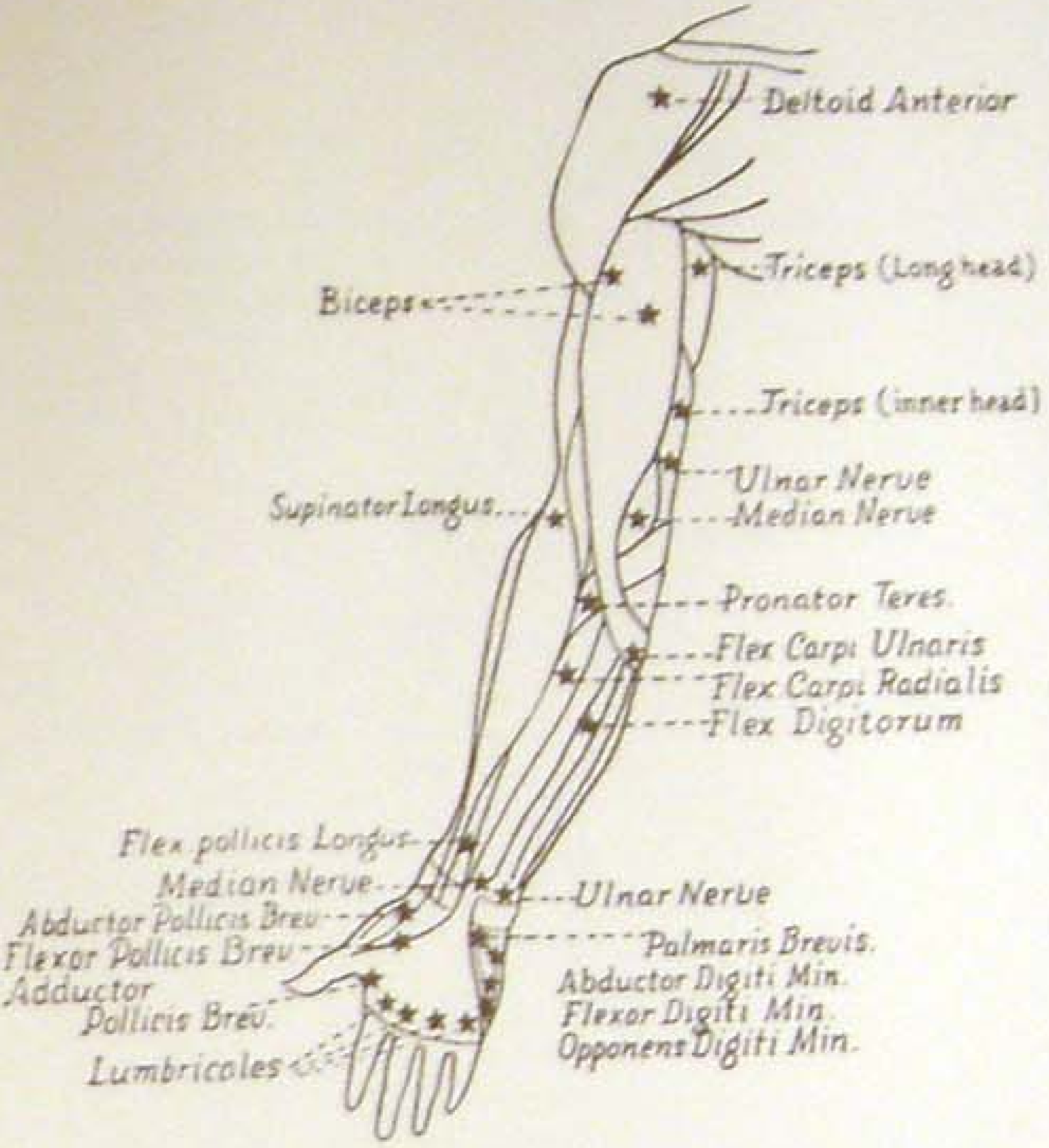
The following general rules must be observed.

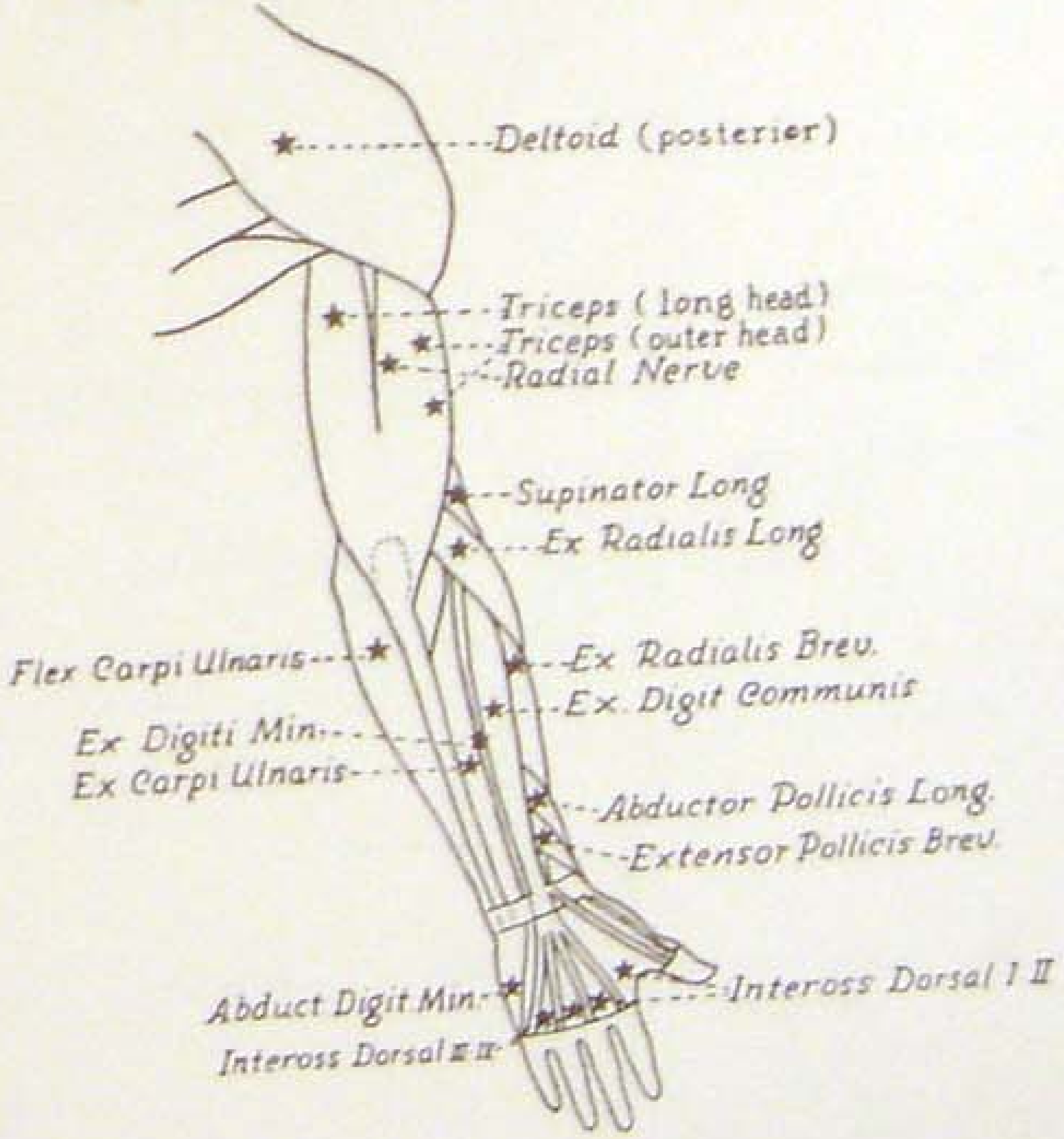
The principal requirement of this method is to localize the current of required density and strength upon parts of the body marked for investigation, avoiding as much as possible unnecessary excitation of the neighboring structures.



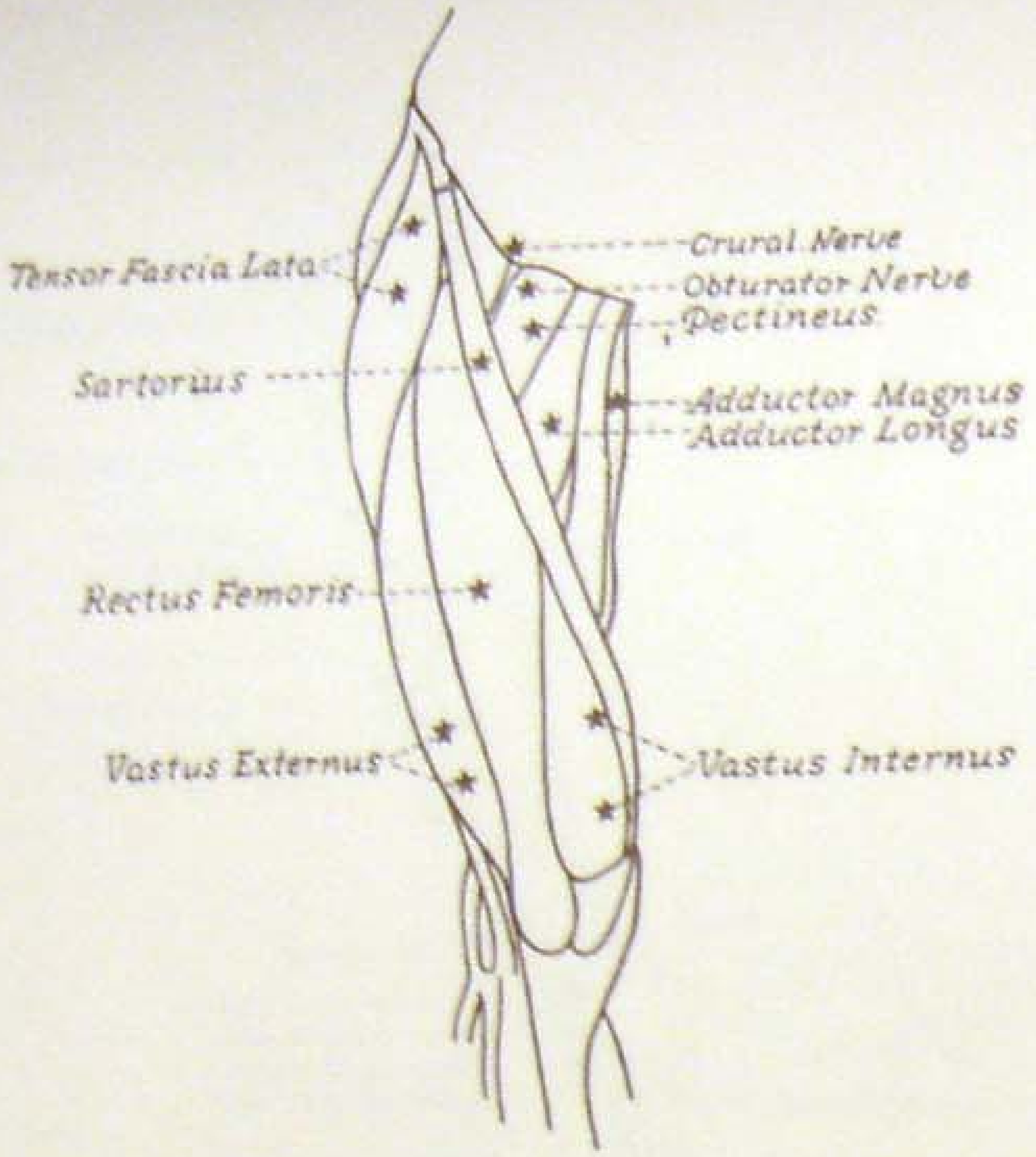
One pole or electrode only should be used for each muscle or nerve reaction expected, and while it is necessary to have a second electrode somewhere to complete the circuit, it is desirable to place this second electrode so as to eliminate effects at its point of contact. It is called the indifferent electrode. It should be much larger than the exciting electrode, which must be of the proper shape and size (usually one inch long by one-half inch wide) not to overlap adjacent tissue.

The operator should become fully familiar with his apparatus and practice by experimentation, possibly upon himself, so as to secure dexterity in manipulation. To secure accuracy in the interpretation of his results, it is advisable to test healthy parts, especially if there is only one side of the body diseased, so that one may obtain a standard of comparison.

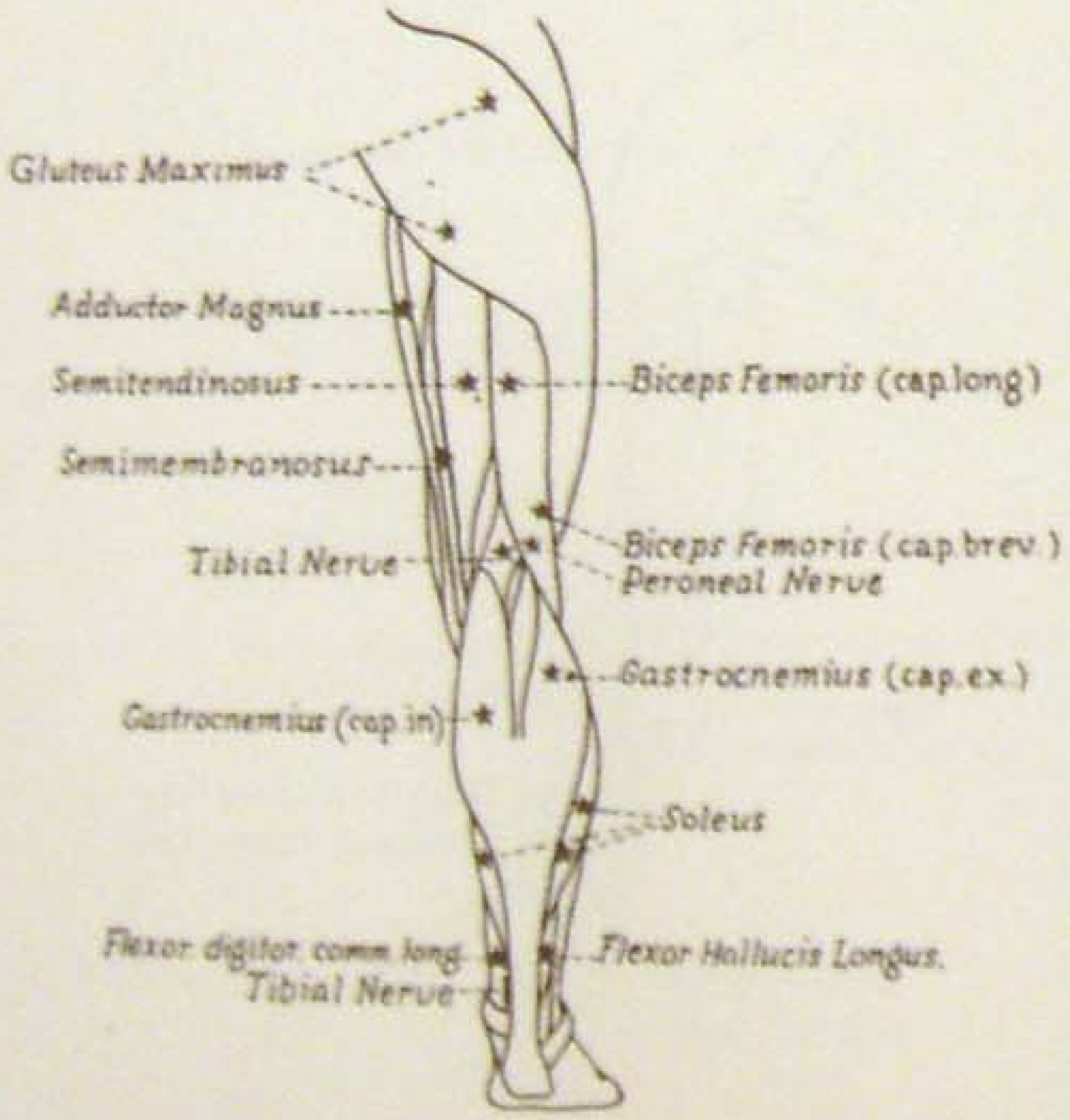




It should always be kept in mind that deeper and more pronounced contractions are obtainable by the pulsating direct current than the others. To determine the strength of the current to be used, the resistance of the parts under examination indicated by the distance between the poles and the degree of paralysis must be considered.



You will observe in the charts reproduced, stars marking the motor points of the muscles and the exits of important nerve trunks, at

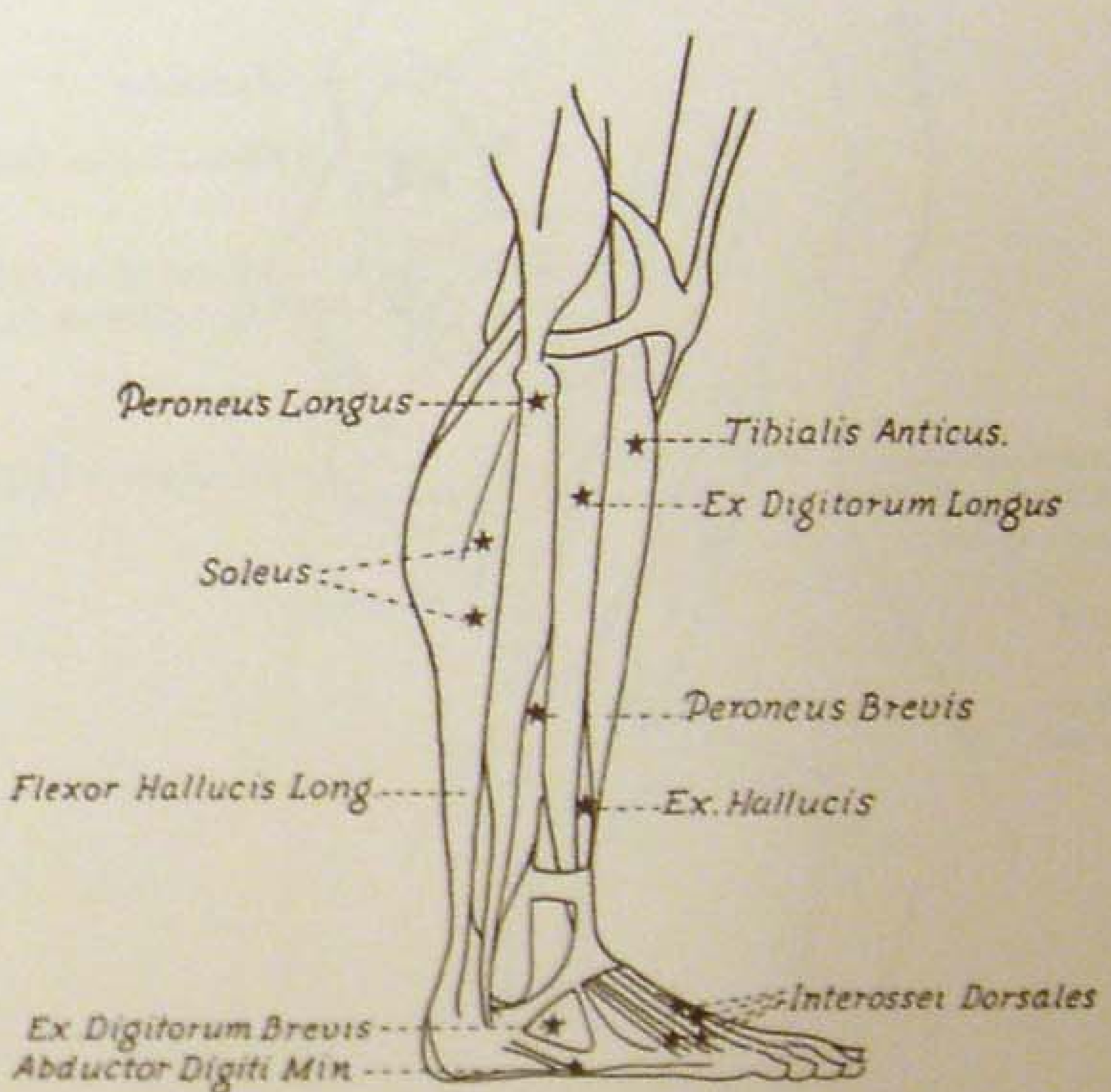


which points electrical susceptibility is the greatest. Application to any of those points about the facial muscles would be more susceptible and less current, therefore, would be required than would be necessary in a similar exploitation of the deltoid muscles or along the sciatic nerve, or similar comparisons in different parts of the body. Reactions are different for different parts of the body, for different patients, also they are modified by disease, either increased or decreased. In sensory involvements, motor reactions may be produced without the patient experiencing much sensation, if any.

Electrical applications to a nerve exit or muscle motor point to determine the amount of excitation should be placed on the spot indicated, by means of the interrupter handle electrodes. This is the better method, although sudden, direct contact is also possible.

Do not move the active electrode in an indifferent manner over the area under examination, as that is not only unsatisfactory, but likely to give the patient an unpleasant muscle contraction.

For all the muscles about the face and neck, the indifferent or



larger electrode may be placed over the lower cervical or upper dorsal vertebra and the various points determined from that.

In the examination of the arm the indifferent electrode may be placed over the nerve supply on the back and the active one over the nerve or muscle or set of muscles, under consideration. If one muscle only is involved, the indifferent electrode may be fastened at the upper insertion of the muscle and the active one applied at the motor point below.

Form 1336

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ADDENDUM

Suggested Technics
for
LOW VOLTAGE APPLICATIONS

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The following suggestions for the application of Low Voltage Therapy represent a review of current literature and recent opinions of recognized authorities on the subject. Specific procedures are limited mainly to general principles and it is recommended that the Physician revise and modify these as desired to accommodate unusual individual requirements.

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ADHESIONS, Fibrous (Preventative)

Objective: Mild contractile stimulation to discourage formation of adhesions following injury or surgery.

Basic Current: Alternating, 2500 cycles per minute frequency.

Wave Form: Surging.

Rate of Impulse: 30 to 40 surges per minute.

Active Electrode: 3" x 3" wet pad over motor points of subject muscles.

Dispersive Electrode: 6" x 8" wet pad over spinal nerve root of subject muscle motor nerve branch.

Duration: 5 to 10 minutes of mild contractions daily or every other day exercising care to avoid additional trauma.

Comment: The same procedure may be inaugurated following abdominal surgery as soon as the scar has fully healed. In this case the active electrode is placed directly over the site of the scar.

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ANKYLOSIS, Fibrous

Objective: Extension of articular motion through decrease in fibrotic limitation by contractile exercise.

Basic Current: Alternating, 360 cycles per minute frequency.

Wave Form: Pulsing.

ANKYLOSIS (continued)

Rate of Impulse:	2 to 4 pulses per second.
Active Electrode:	Muscle testing electrode with small disc over individual motor points, or 3"x3" wet pad over motor point groups, of subject muscles activating articulation involved.
Dispersive Electrode:	6"x8" wet pad over spinal nerve root of subject muscle motor nerve branch.
Duration:	Beginning with 1 or 2 minutes of strong contractions, increase gradually in daily treatments to a total of 15 to 20 minutes.
Comment:	Ankylosis of long standing will necessitate proportional long and vigorous treatment. Resistive motion and corrective exercise are valuable adjuncts in these cases.

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ARTHRITIS

Objective:	Relief of pain and arrest of arthritic process through prolonged vasodilation by ion transfer of "Mecholyl", 0.5% aqueous solution.
Basic Current:	Direct.
Wave Form:	Continuous.
Rate of Impulse:	None. Inoperative on continuous wave form.
Active Electrode:	Connected to "Positive" pole. See "Comment".
Dispersive Electrode:	Connected to "Negative" pole. See "Comment".
Duration:	3 to 15 minutes twice weekly, time being dependent upon current quantity employed. (2 to 3 milliamperes per square inch of active electrode area is suggested.) Discontinue at first sign of any untoward systemic reaction, profuse general perspiration, tachycardia, etc.
Comment:	Refer to Page 11, "Low Voltage Therapy", for details covering the preparation of electrodes for the local or immersion methods.

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BELL'S PALSY

Objective:	Stimulation of facial muscles to sustain tonus and accelerate return to normal function.

BELL'S PALSY (continued)

Basic Current: Alternating, 120 to 2500 cycles per second frequency. Select frequency inducing best contraction with least amount of current.

Wave Form: Surging.

Rate of Impulse: 50 to 60 surges per minute.

Active Electrode: Muscle Testing electrode with small disc over individual motor points of facial muscles involved.

Dispersive Electrode: 4" x 6" wet pad over cervical spine.

Duration: 1 minute of visible contractions in each of the involved muscles. Increase gradually in daily treatments.

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BURSITIS

Objective: Relief of pain and diminution of inflammatory process by prolonged vasodilatation from ion transfer of "Mecholyl", 0.5% aqueous solution.

See "Arthritis" for detailed Technic.

Alternate

Objective: Same as above.

Basic Current: Direct.

Wave Form Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole. 3"x3" wet pad over affected Bursa.

Dispersive Electrode: Negative pole. 4"x6" wet pad at any remote point.

Duration: 10 minutes with 20 to 30 milliamperes, daily in the acute stage.

Comment: After acute symptoms subside, follow with contractile energy as outlined under "Adhesions, Fibrous".

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CERVICAL EROSION

Objective:	Destruction of eroded tissue by Electrolysis.
Basic Current:	Direct.
Wave Form:	Continuous.
Rate of Impulse:	None. Inoperative on continuous wave form.
Active Electrode:	Positive pole. Special bell-shaped bare copper electrode on insulated handle contacting eroded area.
Dispersive Electrode:	Negative pole, 6"x8" wet pad on abdomen.
Duration:	5 to 15 milliamperes until surface of eroded area turns grayish-white, usually 5 to 10 minutes. Reverse polarity for 1 minute before removing electrode from tissue.
Comment:	In the absence of the special bell-shaped bare copper electrode, the same Technic can be used from a carbon ball electrode wrapped in cotton saturated with 5% solution of zinc or copper sulfate.

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CERVICAL STENOSIS, Functional

Objective:	Dilation of the cervical canal by Electrolysis.
Basic Current:	Direct.
Wave Form:	Continuous.
Rate of Impulse:	None. Inoperative on continuous wave form.
Active Electrode:	Negative pole. Special bare copper cervical dilating electrodes in graduated sizes on insulated handle contacting external os.
Dispersive Electrode:	Positive pole. 6"x8" wet pad on the abdomen.
Duration:	3 to 5 milliamperes until dilator slides into cervical canal under gentle pressure.
Comment:	The smallest size of cervical dilator is used for the initial treatment and successive larger sizes are used for each subsequent treatment. The tip of the dilator is engaged in the external os and gentle and continuous pressure is maintained until the instrument slides into the canal easily through the foaming action of Electrolysis. Repeat once weekly.

CONSTIPATION, Chronic

Objective: Increase in motility of colonic musculature through improvement in tonus.

Local Method

Basic Current: Alternating, 360 to 720 cycles per second frequency.

Wave Form: Surging.

Rate of Impulse: 12 to 15 surges per minute.

Active Electrode: 3"x3" wet pad placed over ileocecal juncture.

Dispersive Electrode: 6"x8" wet pad over the spinal lumbar area.

Duration: 10 to 15 minutes total - see "Comment" - repeated daily with decreased intervals as condition warrants.

Comment: The Active pad electrode remains in one position until four or five vigorous contractions have been induced. Then, it is moved about two inches for the next 4 or 5 contractions until the entire course of the ascending, transverse and descending colon have been traced on the abdomen.

Reflex Method

Basic Current: Alternating, 360 to 720 cycles per second frequency.

Wave Form: Surging.

Rate of Impulse: 12 to 15 surges per minute

Active Electrode: 3"x3" wet pad under reclining patient and covering coeliacum ganglion on one side of the spine - about two inches laterally at the level of the third thoracic vertebra.

Dispersive Electrode: 3"x3" wet pad covering coeliacum ganglion on opposite side of spine.

Duration: 10 to 15 minutes vigorous contractions repeated daily with decreasing intervals as condition indicates.

Comment: Mental habit-forming training in fixing some convenient established hour for attempting voluntary evacuation, elimination of any diversion during this period, etc., should be instituted at the beginning of treatment.

DYSMENORRHEA, Functional

Objective: Relief of distress through pH influence and improvement in functional tonicity through contractile stimulation.

Basic Current: 1st stage, Direct.
2nd stage, Alternating, 720 cycles per second frequency.

Wave Form: 1st stage, Continuous.
2nd stage, Surging.

Rate of Impulse: 1st stage, none. Inoperative on continuous wave form.
2nd stage, 15 to 20 surges per minute.

Active Electrode: 1st state, Negative pole. 4" x 6" wet pad on abdomen over uterus and ovaries.
2nd stage, same.

Dispersive Electrode: 1st stage, Positive pole. 6" x 8" wet pad under lumbar area.
2nd stage, same.

Duration: 1st stage, 10 to 15 minutes with 25 to 30 milliamperes.
2nd stage, 10 minutes vigorous contractions.

Comment: Following the initial application of Direct current, without changing the positions of the electrodes, the controls of the apparatus are changed as indicated above for the contractile action. Three treatments weekly between periods is suggested.

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ENDOMETRITIS

Objective: Destruction of infected tissue by Electrolysis.

Basic current: Direct.

Wave Form: Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole. Special bare copper intra-uterine electrodes with insulated tip to prevent puncture of fundus when inserted into the uterus to contact the endometrium.

Dispersive Electrode: Negative pole 6" x 8" wet pad on abdomen.

ENDOMETRITIS (continued)

Duration: 10 minutes with 5 to 10 milliamperes each week or 10 days. BE SURE TO REVERSE POLARITY FOR 2 OR 3 MINUTES BEFORE ATTEMPTING WITHDRAWAL OF THE INTRA-UTERINE ELECTRODE!

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FIBROSIS

Refer to "Ankylosis, Fibrous" for detailed Technic.

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FLAT FOOT

Refer to "Pronation" for detailed Technic.

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FRACTURES

Refer to "Sprains, Strains" for detailed Technic.

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FUNGUS INFECTIONS

Objective: Arrest of infection by ion transfer of copper. (Pereyra suggests 5% solution bis cupric sulfate - trimethylenediamino - with Aerosol MA added to inhibit binding of copper by tissue proteins.)

Basic Current: Direct.

Wave Form: Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole, immersion method. See "Comment".

Dispersive Electrode; Negative pole. 8"x10" wet pad on torso at terminal of extremity.

Duration: 15 to 20 minutes with current equivalent to 2 to 3 milliamperes per square inch of active electrode area.

Comment: See Page 11, "Low Voltage Therapy" for details covering the preparation of electrodes for the local or immersion methods.

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HEMORRHOIDS, Internal and Protruding:

Objective:	Obliteration of hemorrhoid by Electrolysis.
Basic Current:	Direct.
Wave Form:	Continuous.
Rate of Impulse:	None. Inoperative on continuous wave form.
Active Electrode:	Negative pole. Special Hemorrhoidal Needles, with suitable handle, inserted in Hemorrhoid.
Dispersive Electrode:	Positive Pole, 6"x8" wet pad under the buttocks.
Duration:	12 to 15 milliamperes - taking one full minute to advance current from zero to maximum - until hemorrhoid turns dark blue. Allow 3 day interval between treatment of adjacent hemorrhoids.
Comment:	Needle is inserted about 1/16" beneath the mucous membrane and must not perforate the opposite side of point of entrance. Needle is held firmly with its hilt pressing against mucous membrane to prevent escape of hydrogen gas formation.

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HYPERTRICHOSIS (Superfluous Hair)

Objective:	Permanent removal of unwanted hair through destruction of hair follicle by Electrolysis.
Basic Current:	Direct.
Wave Form:	Continuous
Rate of Impulse:	None. Inoperative on continuous wave form.
Active Electrode:	Negative pole. Special Electrolysis Needles, in suitable holder, inserted along hair shaft to reach follicle.
Dispersive Electrode:	Positive pole. 5"x7" wet pad under patient's hand, or glass bowl of water with a contacting strip (See Page 13, "Low Voltage Therapy") into which the patient may dip or remove the hand as instructed by the operator.
Duration:	1 milliampere for 1 minute or until hair grasped by tweezers slides out easily.

HYPERTRICHOSIS (continued)

Comment:	Contiguous hairs should not be removed at one sitting. Usually not more than 4 or 5 hairs are removed at one time from a dime sized skin area.

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LUMBAGO

Objective:	Relief of muscle spasm through sedation and inhibition through contraction.
Basic Current:	1st stage, Direct. 2nd stage, Alternating, 2000 to 2500 cycles per second frequency.
Wave Form:	1st stage, Continuous. 2nd stage, Surging.
Rate of Impulse:	1st stage, none. Inoperative on continuous wave form. 2nd stage, 20 to 25 surges per minute.
Active Electrode:	1st stage, Positive pole. 3"x3" wet pad over lumbar plexus (belly of psoas muscle). 2nd stage, same.
Dispersive Electrode:	1st stage, Negative pole. 6"x8" wet pad over sacrum. 2nd stage, same.
Duration:	1st stage, 10 to 15 minutes with 10 to 15 milliamperes. 2nd stage, 10 minutes of graded contractions, beginning with mild and increasing to vigorous. Treatment may be repeated daily if required.

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METATARSALGIA

Refer to "Pronation" for detailed Technic.

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MYOSITIS

Objective:	Relief of pain and diminution of inflammatory process through vasodilatation.

Refer to "Bursitis" for detailed technic.

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NAEVUS

Refer to "Verucca" for detailed Technic.

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NEURALGIA

Refer to "Neuritis" for detailed Technic.

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NEURITIS

Objective: Sedation of pain and diminution of inflammatory process by pH influence.

Brachial

Basic Current: 1st stage, Direct.
2nd stage, Alternating, 2500 cycles per second frequency.

Wave Form: 1st stage, Continuous.
2nd stage, Pulsing.

Rate of Impulse: 1st stage, none. Inoperative on continuous wave form.
2nd stage, 4 or 5 pulses per second.

Active Electrode: 1st stage, Positive pole. 3"x3" wet pad over brachial plexus.
2nd stage, same.

Dispersive Electrode: 1st stage, Negative pole. 5"x7" wet pad under palmar surface of the hand.
2nd stage, same.

Duration: 1st stage, 10 to 15 minutes with 10 to 15 milliamperes.
2nd stage, 10 minutes of graded contractions progressing from mild to vigorous according to tolerance of patient. Treatment may be repeated daily if required.

Sciatic

Comment: Sciatica is treated in exactly the same manner with the exception that the Active electrode is placed over the sciatic notch and the dispersive electrode on the sole of the foot. If the manifestation is mainly in the lower leg, the active electrode may be placed in the popliteal space.

ENDOMETRITIS (continued)

Duration: 10 minutes with 5 to 10 milliamperes each week or 10 days. BE SURE TO REVERSE POLARITY FOR 2 OR 3 MINUTES BEFORE ATTEMPTING WITHDRAWAL OF THE INTRA-UTERINE ELECTRODE!

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FIBROSIS

Refer to "Ankylosis, Fibrous" for detailed Technic.

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FLAT FOOT

Refer to "Pronation" for detailed Technic.

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FRACTURES

Refer to "Sprains, Strains" for detailed Technic.

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FUNGUS INFECTIONS

Objective: Arrest of infection by ion transfer of copper. (Pereyra suggests 5% solution bis cupric sulfate - trimethylenediamino - with Aerosol MA added to inhibit binding of copper by tissue proteins.)

Basic Current: Direct.

Wave Form: Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole, immersion method. See "Comment".

Dispersive Electrode; Negative pole. 8"x10" wet pad on torso at terminal of extremity.

Duration: 15 to 20 minutes with current equivalent to 2 to 3 milliamperes per square inch of active electrode area.

Comment: See Page 11, "Low Voltage Therapy" for details covering the preparation of electrodes for the local or immersion methods.

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PARALYSIS (continued)

Comment:	Testing of the paralyzed muscle with both Direct current and Alternating current of various frequencies and with both Surging and Pulsing wave forms will reveal which combination induces the most vigorous contraction with the least amount of current. This will depend largely upon the degree of paralysis. Treatment is then to be carried on with this current combination.

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PRONATION - Flat Foot

Objective:	Contractile exercise to counteract muscular weakness contributing to pronation and falling of arches.
Basic Current:	Alternating with 2000 to 2500 cycles per second frequency.
Wave Form:	Surging.
Rate of Impulse:	20 to 30 surges per minute.
Active Electrode:	3" x 3" wet pad over motor point of tibialis anticus - outward aspect of tibia about 3" below the patella.
Dispersive Electrode:	6" x 8" wet pad under sole of the foot and contacting arch. Immersion method (See page 11, "Low Voltage Therapy") utensil filled with salt water may be used.
Duration:	Beginning with 2 minutes of vigorous contractions, increase gradually in alternate day treatments to a total of 10 to 15 minutes.
Comment:	Self-conducted corrective exercises in the home between treatments is recommended.

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RHEUMATISM

Refer to "Arthritis" for detailed Technic.

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SCIATICA

Refer to "Neuritis" for detailed Technic.

SPRAINS and STRAINS

Objective: Removal and resolution of the vascular and lymphatic exudates resulting from trauma of arterioles and lymph channels.

Basic Current: Alternating with 2500 cycle per second frequency.

Wave Form: Surging.

Rate of Impulse: 10 to 20 surges per minute.

Active Electrode: Muscle Testing electrode with small disc over motor points of muscles involved.

Dispersive Electrode: 4" x 6" wet pad over spinal nerve root of subject muscles motor nerve branches.

Duration: Beginning with 2 to 3 minutes of mild contractions, increase both duration and vigor gradually in daily treatments.

Comment: Osborne observes: "This 'massage' is physiologic in type, not possible to produce by hand."

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STRICTURE, Esophageal and Urethral

Objective: Destruction of constricting tissue by Electrolysis.

Basic Current: Direct.

Wave Form: Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Negative pole. Special olive-type bare copper electrodes in graduated sizes on insulated handle contacting constricting tissue.

Dispersive Electrode: Positive pole. 6" x 8" wet pad under dorsal spinal area for Esophageal, lumbar spinal area for Urethral.

Duration: 3 to 5 milliamperes until olive slides through constricting band under gentle pressure.

Comment: The smallest size olive, which will not pass the constricting band, is used for the initial treatment followed by successively larger sizes at each subsequent treatment. Gentle pressure is maintained until olive slips through stricture. Repeat once weekly.

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TENOSYNOVITIS

Refer to "Bursitis" for detailed Technic.

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TORTICOLLIS, Trapezius (Wry Neck)

Treat as for "Lumbago" but with Active Electrode over motor point of trapezius (upper) muscle and Dispersive Electrode over upper dorsal spinal ares.

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ULCER, Indolent

Objective: Removal of waste products and improvement in nutrition by prolonged vasodilatation through ion transfer of "Mecholyl", 5% aqueous solution.

Basic Current: Direct.

Wave Form: Continuous.

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole. Locate above or below ulcerated area - NOT IN CONTACT WITH ULCER - to embrace area between active and dispersive electrodes. See "Comment".

Dispersive Electrode: Negative pole. 6"x8" wet pad, or immersion utensil, at any convenient remote point. See "Comment".

Duration: 5 to 10 minutes twice weekly, time being dependent upon amount of current used. (2 to 3 milliamperes per square inch of active electrode area is recommended.)

Comment: Refer to Page 11, "Low Voltage Therapy", for details covering the preparation of electrodes for local or immersion methods.

Alternate

Objective: Sterilization of the lesion and stimulation of granulation through ion transfer of copper or zinc.

Basic Current: Direct.

Wave Form: Continuous.

ULCER, Indolent (continued)

Rate of Impulse: None. Inoperative on continuous wave form.

Active Electrode: Positive pole. Gauze or cotton pad of sufficient size to cover the ulcer and a slight amount of contiguous healthy tissue. Back by a copper, zinc or block tin metal piece to conduct current. Saturate with 2% copper or zinc sulfate and place in direct contact with ulcerated area.

Dispersive Electrode: Negative pole, 6" x 8" wet pad placed at any convenient remote area.

Duration: 15 to 20 minutes dependent upon amount of current employed based on 2 to 3 milliamperes per square inch of active electrode area.

Comment: After sufficient treatment the surface of the ulcer will become discolored, green with copper or grayish-white with zinc. Treatment may be repeated twice weekly.

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VERRUCA (Warts)

Objective: Destruction of lesion by Electrolysis.

Basic Current: Direct.

Wave Form: Continuous.

Rate of Impulse: None, Inoperative on continuous wave form.

Active Electrode: Negative pole, Small steel needle in suitable insulated handle inserted vertically in center or "criss-cross" laterally through growth.

Dispersive Electrode: Positive pole. 6" x 8" wet pad at any convenient remote area.

Duration: 2 to 5 milliamperes for 1 to 3 minutes, or until hydrogen bubble appears at point of insertion or needle.

Comment: For small verrucae the needle inserted in the center and thrust vertically to the base of the lesion is sufficient. For larger lesions the needle may be thrust through the sides to create a pattern similar to wheel spokes in several applications.

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LOW-VOLT ACCESSORIES

CAT. NO.	ITEM	PRICE
T2671	3" x 3" Wet Pad Electrode	$ 2.85
T2672	3" x 5" Wet Pad Electrode	3.07
T2673	4" x 6" Wet Pad Electrode	3.39
T2674	5" x 7" Wet Pad Electrode	3.82
T2675	6" x 8" Wet Pad Electrode	4.25
T2676	8" x 11" Wet Pad Electrode	6.10
G166	Carbon Ball Electrode	4.90
G165	Copper Ball Electrode	4.90
G160	Cervical Dilator with 5 tips	7.00
G163	Cervical Dilator, Tovey	15.00
G161	Cervical, Bell Shaped Electrode	6.00
G151	Electrolysis Needle Holder	4.00
R28NB	Electrolysis Needles	1.00
G52	Hemorrhoidal Needle Set	9.50
T2625	Hemorrhoidal Needle Set, Keesey	10.00
R534	Intra-Uterine, Ins. Tip 1/8"	3.20
R535	Intra-Uterine, Ins. Tip 3/16"	3.20
R536	Intra-Uterine, Ins. Tip 1/4"	3.20
G181-2	Muscle Testing Electrode, 3 discs	7.00
T2410	Muscle Testing Electrode, 3 discs	13.75
T2628	Urethral Olive Set, 4 tips	10.00
G241	Urethral Olive Set, 12 tips	16.00
F3570	Rubber Bandage, Interlocking, 40"	1.25
F3570A	Rubber Bandage, Interlocking, 18"	.65

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UNIVERSITIES AND SCHOOLS FOR PHYSICAL THERAPY

U. S. Army Medical Service; Medical Field Service School (Brooke, Letterman, and Walter Reed Army Hospitals)	
University of California	San Francisco, Calif.
University of Colorado	Denver, Colorado
University of Connecticut	Storrs, Conn.
University of Iowa	Iowa City, Iowa
University of Illinois	Chicago, Illinois
University of Kansas	Kansas City, Kansas
Emory University	Atlanta, Georgia
Charity Hospital of Louisiana	New Orleans, La.
Boston University (Sargent College)	Boston, Mass.
University of Michigan	Ann Arbor, Mich.
University of Minnesota	Minneapolis, Minn.
Mayo Clinic	Rochester, N. Y.
University of North Carolina	Chapel Hill, N. C.
Duke University	Durham, N. C.
University of Nebraska	Lincoln, Nebraska
Albany Hospital (Physical Therapy School)	Albany, N. Y.
University of Buffalo	Buffalo, N. Y.
Columbia University	New York, N. Y.
New York University	New York, N. Y.
D. T. Watson School of Physiatrics	Leetsdale, Pa.
University of Pennsylvania	Philadelphia, Pa.
University of Texas	Galveston, Texas
University of Virginia	Charlotteville, Va.
Medical College of Virginia	Richmond, Va.
George Washington University	Washington, D. C.
Georgetown University	Washington, D. C.
University of Wisconsin	Madison, Wisc.

GOVERNMENT HOSPITALS (Army, Navy, Veterans Administration, and Public Health)

Walter Reed Hospital	Washington, D. C.
Naval Medical Center	Bethesda, Md.
U. S. Naval Hospital	Philadelphia, Pa.
U. S. Naval Hospital	St. Albans, N. Y.
U. S. Marine Hospital	Carville, La.
U. S. Air Force Hospital	Washington, D. C.
Frances E. Warren Air Force Base	Wyoming
Percy Jones Army Hospital	Battle Creek, Mich.
Fitzsimmons Army Hospital	Denver, Colorado
Murphy Army Hospital	Waltham, Mass.

GOVERNMENT HOSPITALS (Cont'd)

West Point Base Hospital	West Point, N. Y.
Letterman Army Hospital	San Francisco, Calif.
U. S. Public Health Service Hospital	Seattle Washington
U. S. Public Health Service Dispensary	New York, N. Y.
Veterans Administration Hospital	Albany, New York
Veterans Administration Hospital	Bronx, New York
Veterans Administration Hospital	Brooklyn, New York
Veterans Administration Hospital	Buffalo, N. Y.
Veterans Administration Hospital	Charlottesville, Va.
Veterans Administration Hospital	Cleveland, Ohio
Veterans Administration Hospital	East Orange, N. J.
Veterans Administration Hospital	Hines, Illinois
Veterans Administration Hospital	Houston, Texas
Veterans Administration Hospital	Indianapolis, Ind.
Veterans Administration Hospital	Iowa City, Iowa
Veterans Administration Hospital	Lincoln, Nebraska
Veterans Administration Hospital	Little Rock, Ark.
Veterans Administration Hospital	Lyons, N. J.
Baker Veterans Administration Hospital	Martinsburg, W. Va.
Veterans Administration Hospital	McKinney, Texas
Kennedy Veterans Administration Hospital	Memphis, Tenn.
Veterans Administration Hospital	Montrose, New York
Veterans Administration Hospital	New Orleans, La.
Veterans Administration Hospital	Oakland, Calif.
Veterans Administration Hospital	Philadelphia, Pa.
Veterans Administration Hospital	Providence, Rhode Island
Veterans Administration Hospital	Richmond, Va.
Veterans Administration Hospital	Wilkes-Barre, Pa.

HOSPITALS AND REHABILITATION CENTERS

Summit County Rehabilitation Center	Akron, Ohio
Albany Medical College	Albany, New York
Sacred Heart Hospital	Allentown, Pa.
Ardmore Hospital	Atlanta, Ga.
Doctors' Clinic	Auburn, Wash.
Jane C. Phillips Memorial Hospital	Bartlesville, Okla.
Beaver County Society for Crippled Children	Beaver, Pa.
Rehabilitation Service, Inc.	Binghamton, N. Y.
Hillside Home and Hospital	Bridgeport, Conn.
Mercy Hospital	Buffalo, New York
New Chronic Disease Hospital	Buffalo, New York
Sulphur Baths	Centralia, Ill.
Baroness Erlanger Hospital	Chattanooga, Tenn.
Bone and Joint Clinic	Chattanooga, Tenn.
Wesley Memorial Hospital	Chicago, Ill.
American Hospital	Chicago, Ill.
Alexian Brothers Hospital	Chicago, Ill.
Research Hospital	Chicago, Ill.
Mount Sinai Hospital	Chicago, Ill.

HOSPITALS AND REHABILITATION CENTERS (Cont'd)

Cleveland Rehabilitation Center	Cleveland, Ohio
Euclid Clinic	Cleveland, Ohio
C & O Hospital	Clifton Forge, Va.
Lakeview Hospital	Danville, Ill.
Miami Valley Hospital	Dayton, Ohio
Rehabilitation Center of Dayton	Dayton, Ohio
Detroit Memorial Hospital	Detroit, Mich.
Henry Ford Hospital	Detroit, Mich.
North End Clinic	Detroit, Mich.
Receiving Hospital	Detroit, Mich.
West Junior High School	Duluth, Minn.
Glenville Hospital	Euclid, Ohio
Woodrow Wilson Rehabilitation Center	Fishersville, Va.
Natherapath Institute	Freeport, Ill.
Daniel Institute	Ft. Lauderdale, Fla.
O. M. Hamilton Clinic	Garden City, Kansas
Glencove Clinic	Glencove, Minn.
Curative Workshop of Green Bay	Green Bay, Wisc.
Crotched Mountain Rehabilitation Center	Greenfield, New Hampshire
Hartford County Rehabilitation Workshop	Hartford, Conn.
Meadowbrook Hospital	Hempstead, N. Y.
Highwood Hospital	Highwood, Ill.
Irvington General Hospital	Irvington, N. J.
W. A. Foote Memorial Hospital	Jackson, Mich.
Jefferson High School	Jefferson, Pa.
Lynchburg General Hospital	Lynchburg, Va.
Jackson Clinic	Madison, Wisc.
Madison General Hospital	Madison, Wisc.
Manchester Rehabilitation Center	Manchester, N. H.
Campbell Clinic	Memphis, Tenn.
Dade Institute of Physical Medicine and Rehab.	Miami Beach, Fla.
Milan General Hospital	Milan, Illinois
Mountainside Hospital	Montclair, N. J.
Mt. Pleasant Hospital and Clinic	Mt. Pleasant, Texas
Fitkin Memorial Hospital	Neptune, N. J.
Grace-New Haven Community Hospital	New Haven, Conn.
Woodruff Restorative Center	New Haven, Conn.
Charity Hospital	New Orleans, La.
Beekman-Downtown Hospital	New York, N. Y.
Bellevue Hospital	New York, N. Y.
Bird S. Coler Memorial Hospital	New York, N. Y.
Brooklyn Hebrew Home and Hospital	New York, N. Y.
City Hospital, Welfare Island	New York, N. Y.
Francis Delafield Hospital	New York, N. Y.
Frances Schervier Home and Hospital	New York, N. Y.
Harlem Hospital	New York, N. Y.
Home and Hospital of Daughters of Israel	New York, N. Y.
Hospital for Joint Diseases	New York, N. Y.
Institute for Physical Medicine and Rehabilitation	New York, N. Y.
Kings County Hospital	New York, N. Y.
Mary Immaculate Hospital	New York, N. Y.
Misericordia Hospital	New York, N. Y.
Mount Sinai Hospital	New York, N. Y.
Polyclinic Hospital	New York, N. Y.
Presbyterian Hospital	New York, N. Y.
Prospect Heights Hospital	New York, N. Y.
Roosevelt Hospital	New York, N. Y.
St. Charles Hospital	New York, N. Y.
St. Clare's Hospital	New York, N. Y.
St. Vincents Hospital	New York, N. Y.
University Hospital	New York, N. Y.
Norristown State Hospital	Norristown, Pa.
Mountain Clinic	Olean, N. Y.
Florida Sanitarium and Hospital	Orlando, Fla.
Albert Einstein Medical Center	Philadelphia, Pa.
Hospital of the University of Pennsylvania	Philadelphia, Pa.
Jefferson Memorial Hospital	Philadelphia, Pa.
Sidney Hillman Health Center	Philadelphia, Pa.
St. Josephs Hospital	Philadelphia, Pa.
Mercy Hospital	Pittsburgh, Pa.
St. Charles Hospital	Port Jefferson, N. Y.
Portland Rehabilitation Center	Portland, Ore.
St. Luke's Hospital	Racine, Wisc.
Reading Community Hospital	Reading, Pa.
Medical College of Virginia	Richmond, Va.
Lewis-Gale Hospital	Roanoke, Va.
Mayo Clinic	Rochester, N. Y.
Strong Memorial Hospital	Rochester, N. Y.
Home for Chronic Illness	Rocky Hill, Conn.
Sutter Hospital	Sacramento, Calif.
Physical Therapy Center of Sacramento	Sacramento, Calif.
St. Francis Hospital	San Francisco, Calif.
Group Health Center	Seattle, Wash.
Lake City Medical-Dental Clinic	Seattle, Wash.
Seattle Orthopedic Hospital	Seattle, Wash.
Springfield City Hospital	Springfield, Ohio
Rehabilitation Center for Physically Handicapped	Stamford, Conn.
Stamford Hospital	Stamford, Conn.
St. Vincents Hospital	Staten Island, N. Y.
St. Paul Rehabilitation Center	St. Paul, Minn.
Toledo Clinic	Toledo, Ohio
Uniontown High School	Uniontown, Pa.
Doctors Hospital	Washington, D. C.
Freedmens Hospital	Washington, D. C.
Gallinger Municipal Hospital	Washington, D. C.
George Washington University Hospital	Washington, D. C.
Georgetown University Hospital	Washington, D. C.
Children's Country Hospital	Westfield, N. J.
Servants of Mary Hospital	Wheeling, Ill.
Frederickson Clinic	Willmar, Minn.
Wyandotti General Hospital	Wyandotti, Mich.

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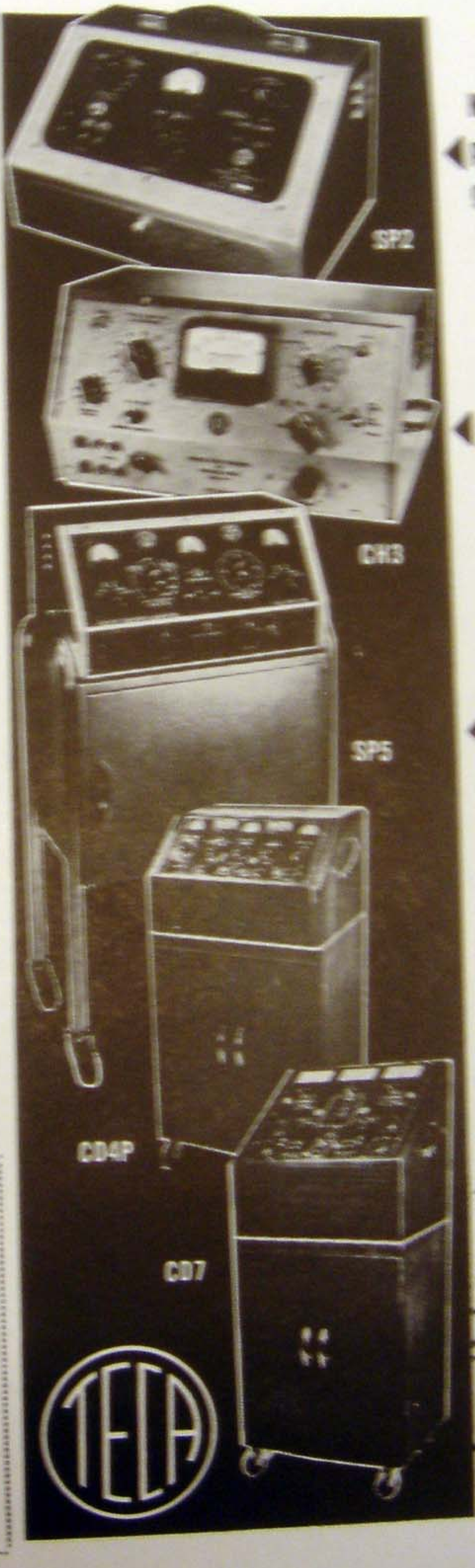

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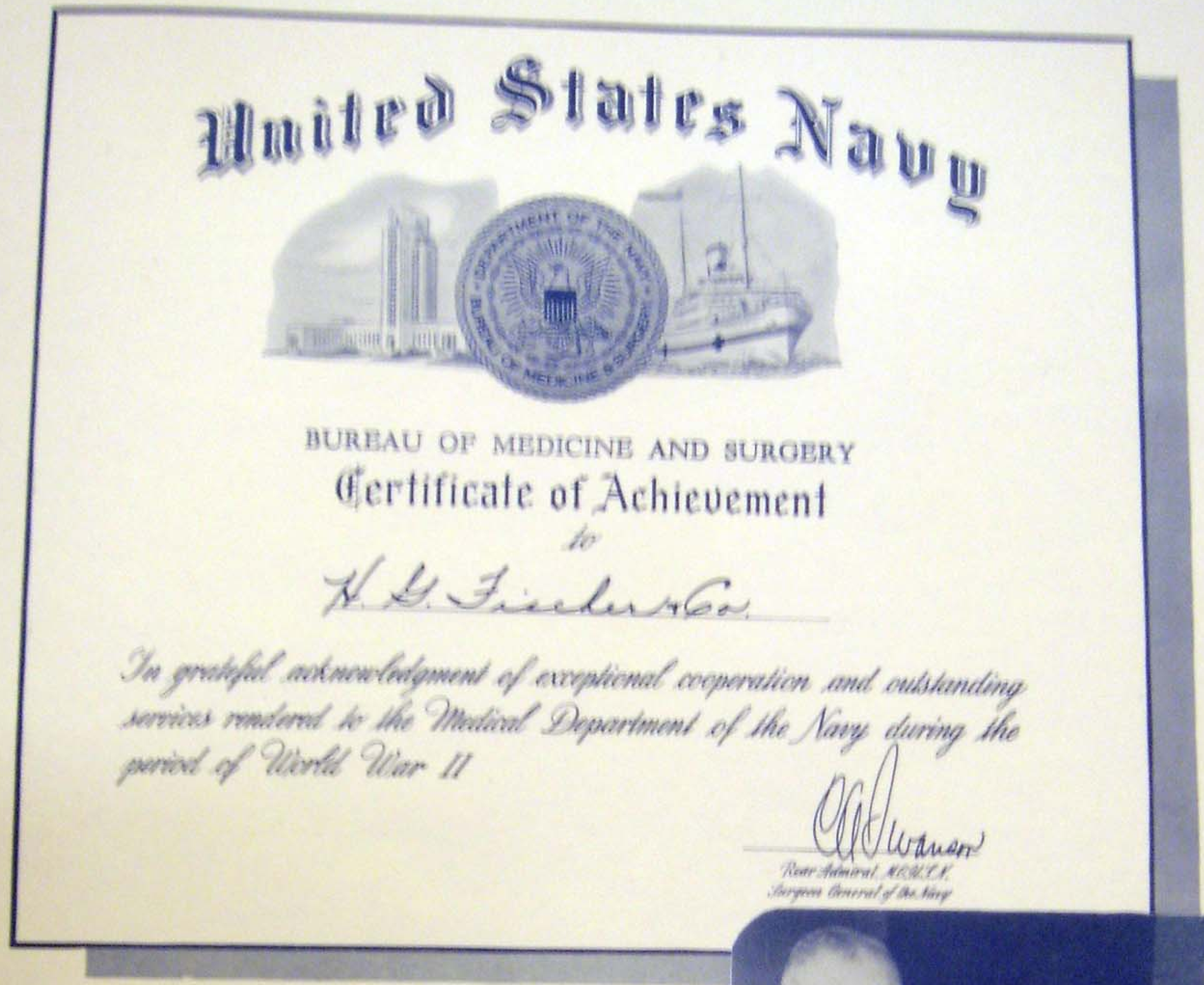

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